U.S. Coast Guard Research and Development Center

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SHORESIDE ALTERNATIVE ENERGY EVALUATION

FINAL REPORT
SEPTEMBER 2002

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16. Abstract (MAXIMUM 200 WORDS)

The Research and Development Center partnered with Air Station Cape Cod to demonstrate use of natural gas as a primary energy source. Many building heating and hot water systems were converted to natural gas, two natural gas powered vehicles were procured through GSA contract, one compressed natural gas vehicle fueling station was installed, and an aircraft tow tractor was converted to natural gas. Natural gas was shown to have many advantages in long-term availability, environmental impact, and equipment maintenance. Further, natural gas has an expanding supply infrastructure, can eliminate the need for underground storage tanks, and may be employed using dual fuel burners (which can burn natural gas or fuel oil) as system redundancy needs dictate. Coast Guard civil engineers and facility managers should consider natural gas technologies foremost when converting or installing fuel-burning equipment. The demonstration of natural gas technologies at Air Station Cape Cod provides Coast Guard energy managers excellent examples of sound and progressive energy management practices. This effort also provides facility managers and engineers throughout the Coast Guard valuable, proven information on which to base future natural gas conversions.

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EXECUTIVE SUMMARY

The Coast Guard is dependent upon fuel oil (largely foreign) for day-to-day operations. The vulnerabilities of this dependence adversely affected mission readiness and operations in the summer of 2000, when fuel budgets were depleted due to volatile fuel oil prices. Only the most essential missions were conducted until the Coast Guard received supplemental funding for fuel. Unless efforts are undertaken to address overall energy consumption efficiency, there is every likelihood that similar problems will occur in the future.

Recognizing the need to reduce Coast Guard dependency upon foreign energy sources, the Research and Development Center initiated a project in November 2000 titled, Shoreside Alternative Energy Evaluation. This study of alternative energies focused on usage of natural gas, and included recommendations on how and where natural gas should be used throughout Coast Guard shore facilities. Coast Guard energy managers are provided with an understanding of issues related to natural gas such as costs, benefits, and logistic availability. This effort aligns closely with Coast Guard energy management goals as outlined in Commandant Instruction 4100.2D, Energy Management, and Executive Order 13123, Greening the Government through Efficient Energy Management.

A demonstration and assessment of the benefits of increased natural gas use was conducted at Air Station Cape Cod, where government vehicles, ground support equipment, and heating system equipment were converted to natural gas. The collaboration with Air Station Cape Cod included Research and Development (R&D) Center sponsorship, and oversight of contracts for the installation of a natural gas fueling station (Fuelmaker™) and conversion of an Air Station Cape Cod aircraft tractor (or mule) engine to natural gas operation.

Natural gas was found to be a very viable energy source for Coast Guard shore facilities and offers many advantages including long-term availability, an expanding pipeline infrastructure, environmental performance, and reduced maintenance. Despite recent short-term price increases, natural gas prices are expected to decline over the next few years. Coast Guard Civil Engineering Unit staffs and Facility Engineers frequently select natural gas as a fuel source, when advantageous, based on local availability, local gas company rate structure, local environmental and underground storage tank regulations, condition of existing equipment, and mission requirements.

The demonstration of natural gas technologies at Air Station Cape Cod provides Coast Guard energy managers with excellent examples of sound, progressive energy management practices. Facility managers and engineers will also find experiences gained in this study very valuable when considering future fuel conversions. It is recommended that natural gas use throughout the Coast Guard expand when economically sensible and logistically practical, with Air Station Cape Cod provided as both a physical model and an information resource.

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Background

The Coast Guard, like the rest of the United States, is very dependent upon fuel oil (largely foreign) for day-to-day operations. During periods of volatility in the oil market, this high dependency on foreign oil has adversely impacted Coast Guard readiness and operations. Over the summer of 2000, as fuel prices hit $2.00 per gallon, cutter schedules were affected as a direct result of fuel budget overruns. Only the most essential missions were conducted until the Coast Guard received supplemental funding for fuel. There is every likelihood that similar overruns will occur in the future. Unless efforts are undertaken to address overall energy consumption efficiency, there is no certainty that the Coast Guard can afford future fuel costs. The vulnerabilities of dependence on fuel oil, combined with increasingly prevalent environmental concerns, provide the Coast Guard good reason to consider alternative energy sources.

Responding to this Coast Guard need in the area of energy management, the Research and Development Center initiated a project in November 2000 titled, Shoreside Alternative Energy Evaluation. This report is provided to document findings for the project's sponsor and other interested parties.

Goals and Anticipated Products

The goal of this effort was to provide Coast Guard energy managers with an understanding of issues related to alternative energy sources such as costs, benefits, and logistic availability. This study of alternative energies focused on usage of natural gas and included recommendations on how and where natural gas should be used throughout Coast Guard shore facilities. The conversion of mobile operational assets (i.e. boats and cutters) to alternative fuels was not studied.

Figure 1. The Research and Development Center in close partnership with Air Station Cape Cod provided Coast Guard energy managers with a better understanding of issues related to increased usage of natural gas at shore facilities.

The product provided was a demonstration and assessment of the benefits associated with increased usage of natural gas at Air Station Cape Cod. This demonstration included conversion of government vehicles, ground support equipment, and heating system equipment to natural gas. It was anticipated that the results of this demonstration at Air Station Cape Cod would offer energy managers the rationale for whether to continue or

expand use of natural gas throughout the Coast Guard and also provide incentive for introducing more alternative fuels and technologies into the Coast Guard's energy suite. Further motivation for this project was obtained by examining data on energy spending Coast Guard wide. It was discovered and considered noteworthy that over 40 percent of the Coast Guard energy budget goes to shore facilities. Accordingly, there was potential for significant cost savings by investing R&D resources in this area.

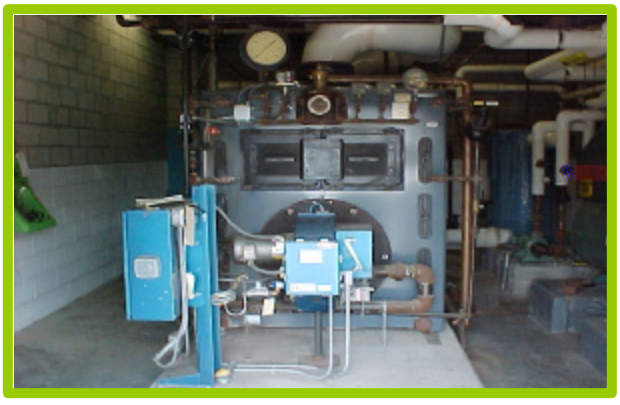
Recognizing Air Station Cape Cod as a leader in utilizing alternative energies, the Research and Development Center established a strong partnership with Air Station Cape Cod at the outset of this project. This partnership led to sharing of resources and ideas in demonstrating across-the-board use of natural gas at an operating Coast Guard facility. By partnering with an actual Coast Guard facility, the results of the study are more likely to have an impact on other facility managers.

This project was concluded after stage two of the five stage New Product Gating process due to the findings that the real need for R&D support in this area, both at program and field levels, was low. After surveying Coast Guard Civil Engineering Units and Facility Engineers, it is apparent that natural gas technology is used when it is advantageous based on local availability, local gas company rate structure, local environmental and underground storage tank regulations, condition of existing equipment, and mission requirements. The local Coast Guard Facility Engineers and Civil Engineering Unit staffs are expected to make informed and correct evaluations, and select optimal systems from those available.

Natural Gas Use at Air Station Cape Cod

Air Station Cape Cod took significant steps towards reaping potential benefits of natural gas by enacting a comprehensive system-by-system oil to gas conversion plan. Over the past several years, all building heating and hot water systems were converted to natural gas, two natural gas powered vehicles were procured through GSA contract, one compressed natural gas vehicle fueling station was installed, and an aircraft tow tractor was converted to natural gas.

Figure 2. Natural gas fired boilers provide clean and efficient space and hot water heating.



In converting building heating and hot water systems to natural gas, the initial infrastructure outlay was significant. Approximately 14 miles of new natural gas pipeline was installed to provide service to 39 industrial boilers and 280 residential housing

heating units. This transition to natural gas eliminated most of the fuel storage tanks on base and drastically reduced emissions from base facilities. The natural gas systems are proving to have reduced maintenance requirements and ancillary benefits of producing far less flue deposits, reducing the need for flue cleaning and decreasing risk of flue fire.

The partnership with Air Station Cape Cod included R&D Center sponsorship and contract support for the conversion of a gasoline powered Pettibone-Tiffin, 8000-pound drawbar pull aircraft tractor (or mule) engine to natural gas operation (Figure 3). The mule engine was converted by a local contractor, at a cost of approximately $9K. The conversion was relatively simple, and accomplished by installing a large compressed natural gas (CNG) tank behind the seats, a small auxiliary CNG tank in place of the original gasoline tank, and an off-the-shelf electronic fuel injection system. The natural gas is injected directly into the air cleaner by a set of computer-controlled injectors. The only modifications made to the engine were removal of the choke assembly and fuel pump, and the addition of an oxygen sensor and exhaust manifold temperature sensor. Included in the contract was training of Air Station Cape Cod personnel on mule engine operation, maintenance, and computer diagnostics. A copy of the mule engine conversion Statement of Work is included in the Appendix.

A laptop computer easily accesses the onboard computer that monitors the engine and controls fuel injection. Using this computer, maintenance personnel can fine-tune the engine for optimal efficiency and emissions, and can also troubleshoot problems before attempting repairs.

Figure 3. Air Station Cape Cod aircraft tractor with engine converted to natural gas, computer diagnostic equipment and compressed natural gas auxiliary fuel tank.

The converted aircraft tractor was received by Air Station Cape Cod in March 2002 and has been in service without trouble since. The CNG tanks on the aircraft tractor are filled by a FuelMaker™ Model FMQ-2-36, also contracted for installation by the Research and Development Center (Figure 4). The Fuelmaker™ was installed by a local contractor and cost approximately $16K. After making proper connections, the unit operates unattended

and can fill the empty aircraft tractor fuel tanks overnight. The tractor can then operate for approximately six hours on its main tank. Included in the contract was training of Air Station Cape Cod personnel on Fuelmaker™ operation and maintenance. A copy of the Fuelmaker™ installation Statement of Work is also included in the Appendix.

Cost data for operating and maintaining the converted mule were not collected as part of this project. Cost savings are expected to become apparent as the converted mule's operating hours increase. The ability to contract for the Fuelmaker™ installation and tractor conversion using qualified local technicians, without hampering day-to-day operations at Air Station Cape Cod, was a valuable part of this technology demonstration.

Air Station Cape Cod is planning to install two additional FuelMakers™ to support additional natural gas vehicles. They will soon be replacing their aluminum, walk-in, maintenance trucks with standard work vans that operate solely on CNG. Although it will take two vans to replace the capacity of one walk-in truck, the cost of leasing two vans will be less than the cost of one walk-in truck due to current GSA lease rates. Additionally, in order to meet goals for use of alternative energy vehicles, the Coast Guard GSA Vehicle Fleet Management is considering covering the additional lease expenses associated with alternative fuel vehicles in FY03, which will make the CNG vans even more economical.

Figure 4. Air Station Cape Cod natural gas powered van, natural gas fueling station, and aircraft tractor with engine converted to natural gas.

Natural Gas Use at Other Coast Guard Shore Facilities

A survey of Coast Guard Civil Engineering Units demonstrates that management of liquid petroleum systems has many variables and pitfalls. Environmental laws and requirements vary greatly state to state. Underground storage tank (UST) maintenance requirements, permits and environmental liabilities often take up significant resources and also vary state to state (COMDTINST M5090.9, Storage Tank Management Manual, provides guidance). In the arena of air quality, the Environmental Protection Agency (EPA) has designated certain areas, where air pollution levels persistently exceed the national ambient air quality standards (under the Clean Air Act of 1990), as "non-attainment" areas. The condition of existing building heating system equipment varies based on age, amount of use, and maintenance history. The types of available energy and their costs differ by geographic region. The need for heating system redundancy and

backup can depend on unit mission and region. Thus, the need and justification to replace existing equipment with new modern equipment varies greatly from facility to facility.

When the time comes to replace or upgrade building heating systems, many factors come into play. A primary concern of Coast Guard Facility Engineers is relief from requirements of UST laws and regulations. Removal or reducing the number of USTs is preferred rather than putting time and money into leak detection equipment, maintenance, and repairs. UST regulations have become primary concerns in new heating system and energy source selection. In some areas, new EPA emission regulations are driving conversions to lower air emission equipment. In other areas, the unit's "environmental conscience" drives air emission reductions. As equipment nears end of service life, Facility Engineers and Civil Engineering Units prudently install modern equipment having maintenance and performance advantages over old, often choosing natural gas fueled equipment.

Local energy baseline costs (see Figure 5), potential cost volatility, projected availability, and the need for system redundancy are also major factors in decisions to replace equipment. In some regions, gas companies offer lower cost "interruptible" rates, where the customer maintains alternate fuel capability (using dual fuel burners which can burn natural gas or fuel oil) and can accept an interruption in service. The actual discounts for customers willing to accept the interruptible rate conditions vary from region to region, but can be significant (in the 20 to 40 percent savings range).

Quarter and Year	Henry Hub, LA	Chicago Citygates	Florida Citygates	Katy, TX	New York Citygates	SoCal Citygate
3rd Quarter 2000	4.47	4.56	5.00	4.48	4.81	5.28
4th Quarter 2000	6.41	6.82	6.73	6.38	8.07	13.59
1st Quarter 2001	6.44	6.61	6.85	6.41	7.83	15.19

Figure 5. Average Quarterly Spot Prices for Selected Trading Centers in Dollars per Million BTU
(Source: Energy Information Administration, Natural Gas Division, adapted from prices reported in *Gas Daily, Financial Times Energy* (various issues).

Commandant Instruction 4100.2D, Energy Management, states, "The Coast Guard is required by law to reduce its overall energy consumption and to minimize the use of petroleum fuel in all its facilities and platforms." The latest revision of this instruction (in review) identifies that the Coast Guard must follow Executive Order 13123, Greening the Government through Efficient Energy Management. One of the specific goals of Executive Order 13123 is to reduce use of petroleum within its facilities: "Agencies may accomplish this reduction by switching to a less greenhouse gas-intensive, non-petroleum source, such as natural gas." One way in which the Coast Guard is already achieving these goals is through the Shore Facility Capital Asset Management Program (SFCAM)

where some projects have conversions to natural gas and upgrades to other energy saving equipment included in them.

At present, the *field level* issues (local operating, maintenance, cost and environmental concerns faced routinely by Facility Engineers and Civil Engineering Units) appear to be driving conversions to natural gas and other modern facility heating equipment. Other *program level* issues (derived from Coast Guard or other government agency policy) may become more prevalent as benefits of alternative energies become more established, Executive Order deadlines approach, and compliance with national environmental policies are given higher priority.

Natural Gas Overview

Natural gas is the frontrunner among alternative energies (such as ethanol, methanol, bio-diesel, and renewables like photovoltaic, wind, geothermal, tidal power, etc.) and offers the best long-term availability, price stability, environmental performance, and reduced maintenance. Primarily composed of methane (CH_4), it is the cleanest burning fossil fuel. Abundantly available in many parts of North America, with an expanding supply infrastructure, natural gas is now the preferred fuel for new electric power generation facilities (Figure 6). This shift to natural gas is driven by improved efficiencies, lower capital costs, reduced construction time, more expeditious permitting and environmental impact advantages.

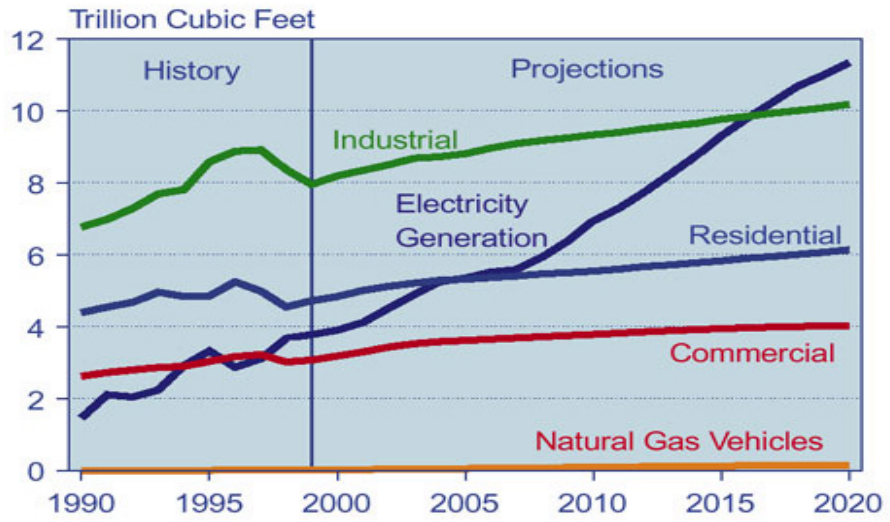


Figure 6. Natural Gas Consumption by Sector, 1999-2030 (Sources – History: Utilities: Energy Information Administration (EIA), *Electric Power Annual 1999*, Vol.1, DOE/EIA-0348(99)/1 (Washington, DC, August 2000). Non-utilities: EIA, Form EIA-867, "Annual Non-utility Power Producer Report, 1998." Other: EIA, *State Energy Data Report 1997*, DOE/EIA-0214(97) (Washington, DC September 2000) Projections: EIA, *Annual Energy Outlook 2001*).

Natural gas use is also expanding at home and work as building heating systems are being converted with increasing frequency. Despite recent short-term price increases, the

technology for using natural gas in the majority of applications is mature and highly feasible. The long-term prospects for stable supplies and prices look favorable (Figure 7).

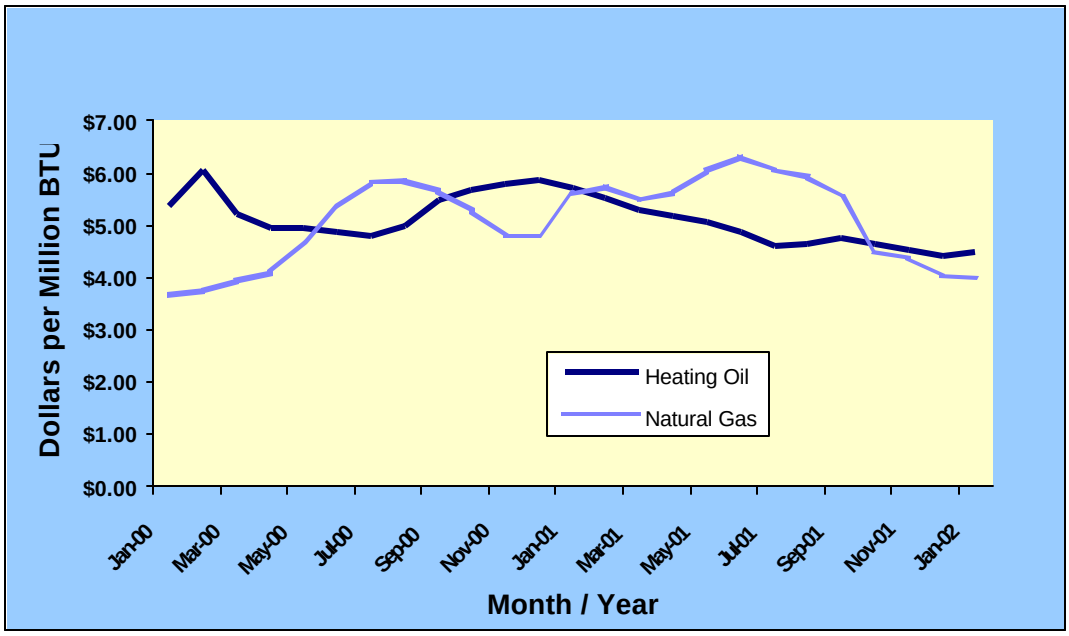


Figure 7. Average Costs of Residential Fuels to U.S. Customers (constant 1982-84 dollars)
(Source: U.S. Dept of Energy, Energy Information Administration. Fuel costs calculated using Urban Consumer Price Index (CPI) in all 50 states and the District of Columbia).

In major cities across the country, public and private vehicle fleets are also moving to natural gas. Within the Department of Transportation, a major alternative vehicle program seeks to promote conversion of government vehicles to natural gas. Leading this increased usage of natural gas vehicles is the expanding natural gas infrastructure (Figure 8). Fueling technology is improving and fueling locations are becoming more accessible; in some locations fueling with natural gas is as simple as filling a tank with gasoline.

Evidence of the expanded use of natural gas vehicles is the fact that many taxicabs and buses, such as the SuperShuttle (providing transportation to and from airports in 15 U.S. cities), have moved to natural gas. Natural gas engines that were often plagued by maintenance and safety problems are now much more reliable and the expected reductions in oil changes, filters, etc., are being realized. Almost all automobile manufacturers now offer dedicated natural gas vehicles. As the number of natural gas powered vehicles manufactured each year increases, it is expected that their 20-30 percent higher cost will decline.

The largest drivers for major shifts in energy sources will likely be national energy policy and world market forces. There is no consensus among experts on whether the shift to energy sources other than oil will be sudden and traumatic (possibly due to unpredictable political events), or gradual and painless, as was the case when the majority of the U.S. population switched from wood to coal to heat their homes.

Federal energy management resources such as the Department of Energy's "SAVEnergy Program" and "Energy Saving Performance Contracts" (ESPC) are utilized by many other agencies (such as Air Force, Navy, Army Corps of Engineers), and by the Coast Guard in some regions (see www.eren.doe.gov/femp/techassist/savenergyprog). Other agency energy conservation programs dwarf that of the Coast Guard (as expected, activity is in direct proportion to budget and staff dedicated to area). Energy related data and program information available from other agencies is also extensive (see www.energy.navy.mil, www.navfac.navy.mil, www.afcesa.af.mil, www.cecer.army.mil.) Many selection and comparison tools are utilized to assist heating system designers and users (see www.eren.doe.gov/femp/techassist/softwaretools/softwaretools). Even as this particular effort ends, there is continuity in the learning process as Air Station Cape Cod's facility and environmental management staff is more than willing to share their experiences with other Coast Guard facility managers interested in converting equipment and vehicles to natural gas. For more Coast Guard specific information on shore energy management, see the Coast Guard Shore Energy Program web site http://cgweb.comdt.uscg.mil/g-sec/energy/index.htm.

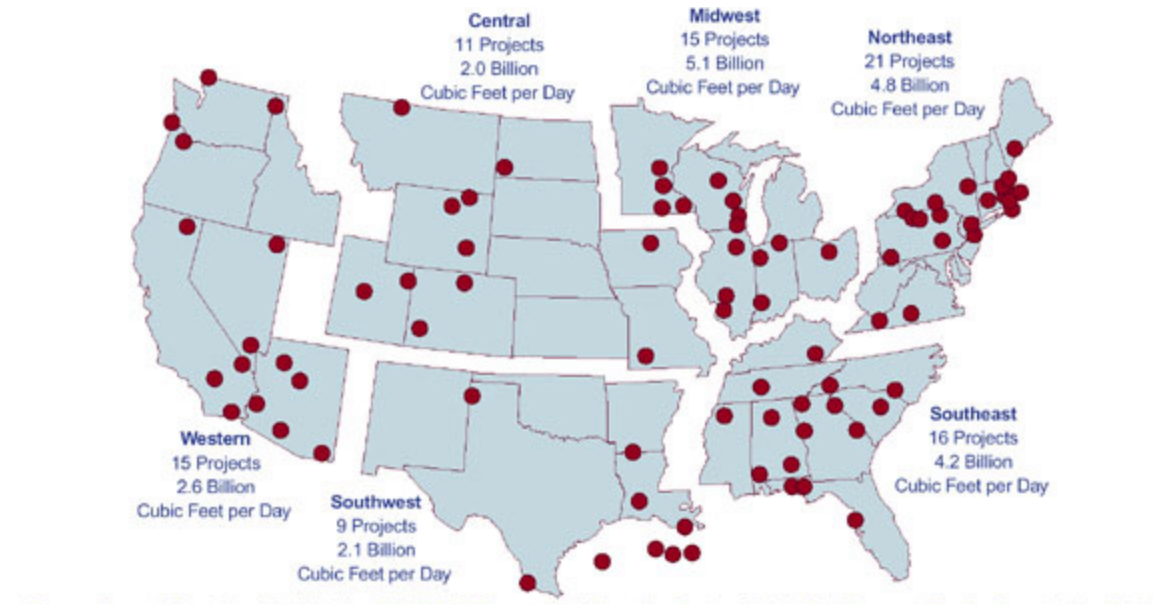


Figure 8. Proposed Natural Gas Pipeline Expansion Projects for 2001 and 2002 (Source – Energy Information Administration, EIAGIS-NG Geographic Information System, Natural Gas Proposed Pipeline Construction Database, as of March 2001).

Conclusions and Recommendations

This project demonstrated that natural gas is a viable energy source for Coast Guard shore facilities. Natural gas technology exists commercially, has an expanding pipeline infrastructure, is safe and easy to use, and offers considerable environmental benefits. While natural gas has, at times, been more expensive than petroleum fuel, natural gas prices on average are expected to decline over the next few years. This demonstration at Air Station Cape Cod provides Coast Guard energy managers with useful information for future fuel conversions. Based on the results from Air Station Cape Cod, it is

recommended that when it makes sense both economically and logistically, the use of natural gas throughout the Coast Guard continue and be expanded.

R&D Center Point of Contact

If you have any questions regarding this project, please contact LCDR Jim Hurley, at (860) 441-2657 or jhurley@rdc.uscg.mil.

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Appendix

STATEMENT OF WORK
FOR
THE CONVERSION OF A PETTIBONE-TIFFIN MODEL 80G AIRCRAFT TOW- TRACTOR FROM THE USE OF GASOLINE AS A FUEL, TO THE USE OF 3,600-PSI COMPRESSED NATURAL GAS (CNG) AS A FUEL

1.0 Background

There are two types of conversion systems available, mechanical (carbureted) and electronic (fuel injected). Mechanical NG systems work on the same principles as spark ignition engines equipped with carburetors that use gasoline as a fuel. Electronic NG systems work on the same principles as spark ignition engines equipped with fuel injectors that use gasoline as a fuel. The future belongs to the electronic systems. According to the University of West Virginia National Alternative Fuel Training Program electronic conversion systems offer the following advantages over the mechanical systems.

- No requirement for a second stage regulator.
- Better emission control.
- Easier starting, particularly in cold weather.
- Better Brake Specific Fuel Consumption (BSFC).
- Quick throttle response.
- Accurate fuel control.
- Possibility of flow rate control on deceleration.
- Pulse Width Modulated (PMW) control strategy.

2.0 Scope

This work can be broken down into three tasks. The first task involves the conversion of a Pettibone-Tiffin Model 80G aircraft tow-tractor from the use of gasoline as a fuel to the use of CNG as a fuel. The second task involves demonstrating that the converted tow tractor can satisfactorily perform the task of towing an aircraft. The third task involves training personnel at AIRSTA Cape Cod in the safe operation, repair and maintenance of the converted tow tractor. The contractor shall craft the CNG system from commercially available parts, and provide all supervision, labor, tools, materials, equipment, shop and other services required to complete the work in accordance with this SOW. The Government will deliver the tow-tractor to the contractor's shop for the conversion, and will take delivery of the tow-tractor at the contractor's shop upon completion of the conversion. Testing shall take place at either the contractor's shop or AIRSTA Cape Cod. Training shall take place at AIRSTA Cape Cod.

3.0 Applicable Standards

3.1 Natural Gas Vehicle Coalition (NGV) Standard NGV-1-P36, Standard for Natural Gas Refueling Nozzles and Refueling Receptacles.

4.0 Requirements

4.1 Task One.

4.1.1 The contractor shall convert a Pettibone-Tiffin Model 80G aircraft tow- tractor from the use of gasoline as a fuel, to the use of 3600-psi CNG as a fuel. The Model 80G tow-tractor has a naturally aspirated, carbureted, spark ignition, 4.9-liter, 6 cylinder, in-line Ford engine. The contractor shall craft a CNG conversion, using commercially available parts and assemblies, that is compatible with the basic body/chassis and the Ford engine of the tow-tractor. The tow-tractor is available for inspection at AIR STA Cape Cod. Although there are no fire and safety standards that directly apply to aircraft ground support equipment, the contractor shall conform to the spirit of existing DOT and NFPA standards for natural gas in comparable applications.

4.1.2 The contractor shall remove all of the existing gasoline fuel system and engine parts that are incompatible with the installation of the new CNG fuel system. Usable parts, e.g. the carburetor, shall be saved and remain the property of the Government. The contractor shall dispose of all unusable parts.

4.1.3 The contractor shall provide two (2) steel, composite edge, CNG fuel tanks rated to hold NG at 3600-psi. One tank shall replace the present gasoline tank, in the gasoline tank's present location. This tank shall be a reserve tank. This tank shall have a capacity that is compatible with the space available, but which holds at least 2.5 gallons. The other tank shall be mounted atop the rear portion of the vehicle, behind the driver and passenger seats. This tank shall be the main fuel tank. It shall have an 11 gallon capacity. Each fuel tank shall be held in place with at least two steel straps (or brackets). Gaskets shall be installed between the tanks and the straps (or brackets) to prevent chaffing. The fuel tanks shall be piped with an accessible valve that will allow the operator to easily switch from the main tank to the reserve tank. The fuel tanks shall be piped to a 3600-psi NG refueling receptacle that conforms to Applicable Document 3.1 (NGV-1-P36). The refueling receptacle shall be compatible with the fuel nozzle on a Model FQM-2-36 FuelMaker™. A steel protective cover shall be placed over the main fuel tank to protect the tank from accidental damage. The cover shall be given a prime coat and two (2) finish coats of automotive paint. The finish shall match the existing yellow color on the tow-tractor. Other areas exposed by the work shall be given similar touch up paint.

4.1.4 The contractor shall provide a conversion that shall include, but not be limited to, for example: a mixer, a pressure regulator, a solenoid shut-off valve, a control valve, an oxygen sensor, fuel injectors, manifolding, and an electronic control unit. The contractor shall provide the necessary fuel piping, and wiring, etc. for the conversion. All of the above work shall conform to the best ASCE practice. Catalog cuts and/or descriptive literature for the conversion components and a basic schematic sketch shall be furnished to the Government for inclusion in the maintenance manuals for the tow-tractors.

4.1.5 Upon completion of the conversion, the contractor shall test the fuel system for leaks under the pressure applicable for each portion of the system. Each mechanical connection shall be leak tested with a soap solution or the equivalent. The system shall be completely leak free before the Government will accept the unit. When the system has been tested and found free of leaks, system shall be tuned-up for optimum performance.

4.2 Task Two.

4.2.1 It is possible that some of the characteristics of a vehicle that is converted to run on an alternative fuel will degrade, e.g. mileage (miles per equivalent gallon of gasoline). The contractor shall demonstrate that the converted aircraft tow-tractor has the basic towing performance of the Pettibone-Tiffin Model 80G aircraft tow-tractor that runs on propane at AIRSTA Cape Cod. The Pettibone-Tiffin Model 80G aircraft tow-tractor that runs on gasoline is rated to pull 10,000 pounds. The contractor shall demonstrate comparable performance at the Dudley Automotive Services, Inc. shop, or tow an aircraft at AIRSTA Cape Cod. If necessary, the contractor shall make the necessary adjustments to the CNG system to achieve this performance.

4.3 Task Three.

4.3.1 The contractor shall provide 8 hours of instruction to up to 6 people in the safe operation, maintenance and repair of the converted Pettibone-Tiffin Model 80G aircraft tow-tractor at the Ground Support Equipment Maintenance Garage Building 3160, CG AIRSTA Cape Cod. The exact number of personnel will be furnished to the contractor two weeks prior to the training. The contractor shall provide diagnostic software, loaded into a Government furnished laptop computer for this training.

Statement of Work for the Installation of a Model FMQ-2-36 FuelMaker™ at the Ground Support Equipment Garage, Building 3160, U.S.C.G. Air Station Cape Cod

SECTION 01010

GENERAL SECTION
MODIFIED 03/30/01

GENERAL

GENERAL DESCRIPTION

The Contractor shall provide all supervision, labor, tools, materials, transportation, equipment, and other services as necessary to complete work in accordance with this specification. Work consists of, but is not limited to the following:

a. Installation of one (1) Government furnished, natural gas, slow fill, 3,600 psi, vehicle refueling appliance, with two nozzles, in accordance with the "Installation and Service Instructions" for a Model FMQ-2-36 Fuel Maker (39.0043, Issue 3, January 1999),
b. Furnish and install one natural gas meter and approximately 75 ft of piping to natural gas line, buried a minimum of 42" below surface of the ground with warning tape,
c. Install 3' w X 3' l X 4" d 4,000 psi concrete pad on a 6" subbase of crushed stone.
d. Install 4 - 4" dia. concrete-filled steel pipe (lolly column) bollards to protect the FuelMaker™ (see sketch on attached Civil Site Plan),
e. Install electrical conduit, breaker, wiring, emergency push-button shut-off switch,
f. Pressure test piping, valves. meter and all connections per NFPA,
g. Obtain digsafe permits,
h. Furnish and install State of Massachusetts required warning signage,
i. Pressure and electrical testing and certification of the filling system, site restoration, installation of protective bollards, signage, and other appurtenances as necessary to make system complete, operational and fully functional.
j. Site restoration and cleanup and
k. Operational testing, operational instructions, and on-site 4 hour class for 12 (twelve) government employees on use, maintenance, care, and proper safety procedures.

Note: Requirements c. and d. above take precedence over the requirements of FuelMaker™ "Installation and Service Instructions". The installation shall conform to the applicable specifications and standards, and other provisions of Section 15199.

SUBMITTALS

The Contractor shall submit to the COTR all submittal required items followed with a 'G' and those items listed in a the Submittal Register sheet:

a. Install Slow fill, natural gas compressor for refueling CNG vehicles as specified herein: G
b. digsafe numbers G
c. plans G
d. work schedule G
e. Natural Gas supplier approval G
f. Manufacturers installation instructions G
g. Warranties G
h. Trenching plan G
i. Gas Pipe welder certification G
j. Commercial electricians license G

Note: A sample Submittal Register Sheet is attached. Submittals are only required if necessary, e.g. if the gas piping uses threaded fittings, then a welders certificate is not required.

LOCATION

The work specified shall be performed at the U.S. Coast Guard properties located at Air Station Cape Cod, building 3160 Herbert Rd and 5215 East hospital Rd, C.G. Air Station Cape Cod, MA. 02542. The location is indicated on the attached Civil Site Plan.

HOURS OF WORK

All work shall be performed between the hours of 7:30 a.m. and 4:00 p.m., local time, Monday through Friday (excluding Federal Holidays) inclusive. If the Contractor desires to carry on work outside these hours he shall submit an application to the Contracting Officer for approval at least five (5) working days in advance. No work outside the regular hours established above shall be undertaken without prior approval.

SANITATION FACILITIES

The contractor may use the bathroom facilities in building 3160 provided that the contractor and employees do not add additional cleaning burden to the Coast Guard.

SUBMITTAL DESCRIPTION

Samples, catalog cuts, shop drawings, and other information shall be submitted by the Contractor as required by the list of submittals on the Submittal Register Form(s) which is included in this specification. No other forms shall be used or will be accepted by the COTR. Questions about submittals shall be addressed to the COTR.

DISPOSAL OF REMOVED MATERIALS

All materials removed by the Contractor that is not indicated to be salvaged by the Government shall become the property of the Contractor. This material shall be disposed of by the Contractor at a Massachusetts Department Of Environmental Protection (MADEP) certified solid waste facility. The Contractor shall not cause, suffer, allow, or permit handling, transportation, or storage of any material in a manner that results, or may result, in emissions that cause or contribute to a condition of air pollution.

COORDINATION OF CONTRACT WORK WITH GOVERNMENT ACTIVITES

The Government will continue to operate within its buildings, and areas during the execution of the contract. The Government will keep interference with the Contractor's operations to a minimum. The Contractor shall conduct his/her operations so as not to interfere with the Government's or use of the site and building.

TEMPORARY PROTECTION

The Contractor shall provide temporary protection and take necessary precautions to ensure no debris, materials, dust, equipment, or personnel endanger the safety of Government personnel, other contractors, residents, or guests while in the area where work is being performed. This Includes protection of the interior and interior furnishing both government and occupant owned from any damage including damage caused by weather due to this work.

SCHEDULE OF VALUES

Upon the Contracting Officer's request, and prior to the beginning of work, the Contractor shall prepare and deliver to the Contracting Officer a schedule of values. The schedule of values shall consist of a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, the unit prices, and the total prices. The schedule must be based on the actual breakdown of the quote price. Accordingly, potential SubContractor who may be involved in the work shall be advised of this requirement in order to furnish such data without delay. The cost of insurance shall not be listed as a separate item, but included as part of each item of work. If progress payments will be requested for materials delivered to the construction site, that particular item of work must be broken down into separate materials and labor cost. For contracts having a duration of less than one week and with one billing a cost breakdown is not required.

ENVIRONMENTAL COMPLIANCE

The Contractor shall submit a list of all hazardous materials with Material Safety Data Sheets (MSDS) to the COTR for approval prior to work commencement on this project. Storage of hazardous materials will not be permitted on the Reservation. All materials used by the Contractor shall comply with VOC Emission limits for use in the Commonwealth of Massachusetts (310 CMR 7.00). Cleaning and maintenance of the Contractor's and SubContractor's equipment shall not be conducted on the Reservation. The Contractor is responsible to comply with all applicable Federal and State environmental regulations. The Contractor shall submit to the COTR the following:

a. Bill of Lading for all disposed materials. G

b. Copy of receiving landfills operating permit or recyclers operating permit. G

SCHEDULE OF WORK

The Contractor shall furnish Schedule Of Work that includes start and completion dates of each major item of work. The schedule include all work performed by SubContactors. This is a required submittal:

a. Schedule of Work G

WORK COMPLETION

All work under this contract including site cleanup, punch list, acceptance by the COTR and required submittals shall be completed within thirty (30) calender days of issuance of the purchase order by the Contracting officer unless stated otherwise.

SPECIAL JOB REQUIREMENTS

The contractor shall take all necessary safety precautions to protect open trenches and road cuts from cave-ins, falls, and other open-trench hazards. All trenches shall be covered after each work shift. Road cuts and across road trenching shall be covered with steel plates capable of carrying a 10-ton axle load with no danger of collapse. Erect warning barricades meeting the Commonwealth of Mass highway requirements.